H/E/TX

Reg. No: 23BYD0053

Final Assessment Test – May 2024

Vellore Institute of Technology

Course: BEVD101L - Electronic Materials

Class NBR(s): 0582 Slot: B1+TB1

Time: Three Hours Max. Marks: 100

- KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Consider a lattice with primitive lattice vectors: $2a_x$ and a_x+a_y. Calculate the reciprocal lattice vectors, sketch the reciprocal lattice points and draw the first Brillouin zone. [3+3+4] $\vec{g_1}=$

2. Consider a BCC lattice of side a. Deduce the number of lattice points per unit cell, the number of nearest neighbors and, the atomic packing fraction of the cell. [3+3+4]

2
68.0171
8

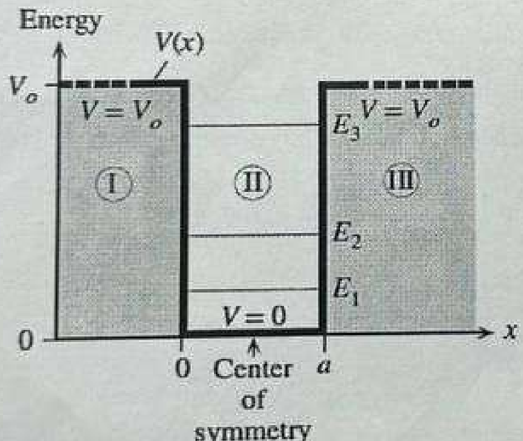
3. A simple cubic crystal has a lattice constant a = 0.3 nm. X-ray of wavelength 0.15 nm are incident on the set of (111) planes of the crystal. Calculate the vector normal to the set of (111) planes and the angle at which the diffraction maximum can be observed. [5+5]

$\frac{1}{\sqrt{3}}(\vec{a_x}+\vec{a_y}+\vec{a_z})$
$d = 0.173 \times 10^{-9}$ m
$\theta = 25.658$
$\theta = 54.997^\circ$

4. It is given that the mobility of the electrons in copper is 43.4 $cm^2V^{-1}s$-1 and the conductivity of copper is 5.9×10^7 $\Omega^{-1}m^{-1}$.What is the applied electric field that will impose a drift velocity equal to 0.1 percent of the mean speed $v = 10^6$ m s^{-1} of conduction electrons in copper? What is the corresponding current density and current through a Cu wire of diameter 1 mm? [6+4]

$V_d = 1000$
$E = 2.304 \times 10^{-5}$ Vm^{-1}
$J = 1.359 \times 10^{13}$ Am^{-2}
$I = 10.672$ MA

5.(a) Consider an electron in a finite potential well as shown below [10]



7.684
$E_1 = 0.0312$
$E_2 = 0.124$

where V_0 = 0.7 eV and a = 3 nm. For E < V_0, calculate the bound state energies E_1 and E_2.

OR